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mountains, is solitude complete and unbroken. Whatever be the charm, it is yet certain that having gazed once we admire the strange picture ever after.

REVIEWS.

Report upon Deep Sea Dredgings in the Gulf Stream.* — This number of the Bulletin sums up the results of the different expeditions, and is also especially valuable for many novel and interesting observations upon geological and zoölogical questions. According to Professor Agassiz, the fauna of the reef, consisting mainly of corals, extends to ten fathoms only. The second zone, "a muddy mass of dead and broken shells, broken corals, and coarse coral sand, is chiefly inhabited by worms, and such shells as by their nature seek soil of this character, with a few small species of living corals, some *Halcyonarians*, and a good many *Algæ*." This extends seaward "from a few miles" off Cape Florida to "twenty miles and more off Cape Sable." "A third region, or zone, beginning at a depth of about fifty or sixty fathoms, and extending to a depth of from two hundred to two hundred and fifty fathoms, constitutes a broad slanting table land, beyond which the sea bottom sinks abruptly into deeper waters. The floor of this zone is rocky; it is, in fact, a limestone conglomerate, a kind of lumachelle, composed entirely of the remains of organized beings, animals now living upon its surface." Algæ are but sparsely represented upon the plateau, and though the animals are abundant, the species are generally of small size and belong to genera either identical or closely allied to those of the Cretaceous period. The deep sea proper beyond this zone lies upon "a uniform accumulation of thick, adhesive mud, with a variety of worms and such shells as seek muddy bottoms." Professor Agassiz thinks that if the bottom in these depths was rocky, animal life would be "as varied and as numerous comparatively as are the Alpine plants on the very limits of perpetual snow."

With reference to geology, Professor Agassiz says that he infers from the character of the sea bottom that probably none of the layers of stratified rock on the surface of the globe "have been formed in very deep waters," but around the shore lines of the ancient continents, which have been subject only to comparatively slight changes of level after they were once elevated above the primeval ocean.

In the main bearing of this conclusion Professor Agassiz agrees with

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* Bulletin of the Museum of Comparative Zoology. No. 13. Report upon Deep Sea Dredgings in the Gulf Stream during the Third Cruise of the U. S. Steamer Bibb; addressed to Professor B. Peirce, Supt. U. S. Coast Survey. By Louis Agassiz. pp. 363-386. Cambridge, 1869.

Dana's theory of the gradual development of continents, a view which of late has been steadily gaining in adherents, especially in this country. The statement, however, that probably no stratified rock has been formed in deep water is open to serious objections. The Chalk, the Nummulitic limestone, the Eozoonal limestone and others of like constitution are composed in great part of Foraminiferous animals especially fitted to flourish at great depths, and, probably, so far as we can judge from soundings and dredgings, covering at the present day a large portion of the Atlantic bottom.

The description of the physical contrast between the shelving of the Florida shore and the abruptness of the Cuban side and Bahama reefs, with the minute analysis of the formation and disintegration of the rocks of the Double Headed Shot Key, Salt Key, and others, will be read with the greatest interest by all geologists. We could not do justice to this part of the publication without quoting several entire pages, and this we have not space for.

Generally speaking the Keys are formed, according to Professor Agassiz, of fine coral sand, which is washed up on to the higher shallower parts, and form banks, upon which accumulate a conglomerate of broken shells, corals and coarse oölithes to the height of high water mark. Upon this foundation rock reposes another accumulation of similar material, distinguished, however, by the steep inclinations of the beds which rise to the height of twelve or fifteen feet. These last furnish the fine material which is swept away by the wind to form sand dunes.

The more homogeneous limestones are formed in the less exposed places, and Professor Agassiz mentions that these are "frequently as hard as the hardest limestone of the secondary formation."

The author then passes to the consideration of the development of Corals, and states that these investigations have led him to regard the *Actinians* as the lowest; the *Madreporarians* next; and the *Halcyonarians* as the highest among the corals. Among the Madrepores the sequence of the genera is *Turbinolia*, *Fungia*, *Astræa* and *Madrepora*. "Young Astræans, before assuming their solid frame, are Actinia-like; their first coral frame is Turbinolia-like, and from that stage they pass into a Fungia-like condition, before they assume their characteristic Astræan features." It is next proved, that the succession of types in geological times, and their bathymetrical distribution from the deepest water to the shallow, corresponds so far as the Madreporarians are concerned to the succession in rank of the adult types as determined by different phases of their development. Thus both as regards rank in classification, and the succession of the different phases of development, as well as the successive appearance of types in the progress of geological time, and the vertical distribution of these types on the seashore, the Turbinolian type is found first and is followed in succession by the Fungian, the Astræan, and the Madreporian types. These views also seem to be in accord with those of Alexander Agassiz, who, as previously cited, compares the deep water Echinoids to the Cretaceous, and those of intermediate depths to Tertiary genera. It would seem, therefore, if the latter be true, that, *a priori*, the former would acquire a still higher degree of probability, so far as the agreement of the succession in time and depth is concerned.

TRANSACTIONS OF THE CHICAGO ACADEMY OF SCIENCES.*—This part completes the first volume of "Transactions" and in interest and value, and the beauty of the plates, fully maintains the high standard of the preceding part. The plates, which are costly, are presented by the Trustees of the Academy, an evidence of their immediate interest in the scientific and literary reputation of their city. Nearly half of the volume is devoted to a biography of Robert Kennicott, the first Director of the Academy, from the pen of Dr. Stimpson, his successor, and the editor of the present volume. It will be read with great interest as the record of a daring explorer and admirable field naturalist.

Dr. J. W. Foster contributes an exceedingly interesting paper "On the Antiquity of Man in North America." Among the proofs of his great antiquity he claims that "the discovery (by Professor Whitney) of a human skull in California during the past season, buried deep in the gold drift, and covered with five successive overflows of lava, carries back the advent of man to a period more remote than any evidences thus far afforded by the stone implements in the drift of Abbeville and Amiens, in the valley of the Somme, or the human skeleton in the loess of the Rhine; and although the fossil elephant (*E. primigenius*) existed in Europe during the glacial epoch, and survived through the valley-drift and loess (which I think may be regarded as contemporary, though different in the form of the materials, and indicating a difference in the transporting power of the current), this association of the remains of the elephant and man has not thus far been found to exist in the purely glacial deposits." He also cites the statement of the late Dr. Koch, that in connection with the remains of the Mammoth found in the Osage valley of Missouri, "were found flint arrowheads and remains of charcoal, as though the aborigines had attacked and destroyed the animal when mired. This statement was received at the time, by the scientific world, with a sneer of contempt. Last spring I questioned him as to the possibility of his having been mistaken, when he assured me, in the most solemn and emphatic manner, that it was true."

He describes the remains of the mound builders, figuring various implements, and recapitulates the evidence of their "advance in civilization beyond a mere barbaric race," as drawn from their textile fabrics, comprising cloth "possessing an uniform and well twisted thread, coarse, and of a vegetable fibre, allied to hemp," and "regularly spun with an uniform thread, and woven with a warp and woof." It was taken from two

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*Vol. i, Part II. Chicago, 1869. Royal 8vo, pp. 133 to 337. With a portrait and thirteen plates, mostly colored.